AMENDMENTS TO THE DRAWINGS:

The attached sheets of formal drawings include changes to figures 1-5. These sheets, which include figures 1-5, replace the original sheets including figures 1-5. In the figures, the number labels have been clarified.

Attachment: Replacement Sheets (Figures 1-5)

REMARKS

The Office Action dated October 25, 2006 has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto.

Claims 1-16 have been amended to more particularly point out and distinctly claim the subject matter of the invention. New claims 17 and 18 have been added. No new matter has been added. Thus, claims 1-18 are currently pending in the application and are respectfully submitted for consideration.

The Office Action objected to the drawings because the number labels are not readable. Formal drawings, which do not include hand-written labels, are being submitted herewith. Accordingly, Applicants respectfully submit that this objection is rendered moot.

The Office Action rejected claims 1-5, 8-12, and 15-16 as being unpatentable over Yang (U.S. Patent No. 6,504,862) in view of Wright (U.S. Patent Pub. No. 2002/0101936). The Office Action took the position that Yang discloses all of the elements of the claims, with the exception of applying a least squares function to the residual signal for at least one carrier of the multi-carrier signal, thereby generating a minimized residual signal for the at least one carrier. The Office Action then cites Wright as allegedly curing this deficiency in Yang. The rejection is respectfully traversed for the following reasons.

Claim 1, upon which claims 2-7 are dependent, recites a method which includes generating a residual signal from a multicarrier signal, the residual signal representing a difference between the multicarrier signal and a hard-clipped multicarrier signal. The method also includes applying a least squares function to the residual signal for at least one carrier of the multi-carrier signal, thereby generating a minimized residual signal for the at least one carrier, and combining the minimized residual signals and the multicarrier signal.

Claim 8, upon which claims 9-14 are dependent, recites an apparatus comprising a generating unit configured to generate a residual signal from a multicarrier signal, the residual signal representing a difference between the multicarrier signal and a hard-clipped multicarrier signal, and an applying unit configured to apply a least squares function to the residual signal for at least one carrier of the multi-carrier signal, thereby generating a minimized residual signal for the at least one carrier. The apparatus also includes a combining unit configured to combine the minimized residual signals and the multicarrier signal.

Claim 15, upon which claim 16 is dependent, recites a mobile communication system comprising a transmitter apparatus configured to reduce a peak-to-mean ratio of a multi-carrier signal, a generating unit configured to generate a residual signal from a multicarrier signal, the residual signal representing a difference between the multicarrier signal and a hard-clipped multicarrier signal. The mobile communication system also includes an applying unit configured to apply a least squares function to the residual

signal for at least one carrier of the multi-carrier signal, thereby generating a minimized residual signal for the at least one carrier, and a combining unit configured to combine the minimized residual signals and the multicarrier signal.

Therefore, the present invention relates to the reduction of the peak-to-mean average amplitude in a signal transmitted in a power amplifier, and particularly, but not exclusively, to such reduction in the power amplifier of a multicarrier communication system utilizing an EDGE clipper. The present invention applies a least squares function in order to minimize a cost function with respect to the signal properties that must be maintained and the amount of clipping required for a residual signal that can be used to reduce signal peaks in the composite signal. The use of the least squares function allows embodiments of the present invention to be used in relation to EDGE systems.

As will be discussed below, the combination of Yang and Wright fails to disclose or suggest all of the elements of the claims, and therefore fails to provide the advantages and features discussed above.

Yang discloses a method and apparatus for reducing the peak power probability of a spread spectrum signal by clipping the signal to constrain its spectrum within error-shaped bounds. The method includes generating a clipping threshold signal, generating a clipping error signal responsive to both the clipping threshold signal and the spread spectrum signal, filtering the clipping error signal to produce a shaped error signal, and subtracting the shaped error signal from the spread spectrum signal.

Wright discloses a waveshaping circuit that digitally modifies data in a data stream to decrease the amplitude of signal peaks in a waveform. The waveshaping circuit includes a preconditioning circuit, a pulse generator, a delay circuit and a summing circuit. The preconditioning circuit receives an input symbol stream and compares data in the input symbol stream to a first reference. The preconditioning circuit modifies the data in the input symbol stream by applying a first impulse to the input symbol stream selected to at least partially reduce the magnitude of a signal peak in the first waveform when the input symbol stream exceeds the first reference. The preconditioning circuit further provides the modified symbol stream as an input to a pulse-shaping filter, which maps the modified symbol stream to a baseband stream. The pulse-shaping filter is configured to provide the baseband stream to a mixer, which upconverts the baseband stream by multiplication with an oscillator signal from an oscillator to an upconverted signal. The pulse generator receives the upconverted signal and receives phase information from the oscillator. The pulse generator generates a band-limited pulse when the pulse generator detects that the upconverted signal has a signal crest above a predetermined threshold. The delay circuit is configured to delay the upconverted signal to a delayed upconverted signal, where an amount of delay is approximately equal to a latency in the pulse generator. The summing circuit is adapted to sum the band-limited pulse from the pulse generator with the delayed upconverted signal from the delay circuit to generate the first waveform.

Applicants respectfully submit that the combination of Yang and Wright fails to disclose or suggest all of the elements of the present claims. For example, Yang and Wright do not disclose or suggest "generating a residual signal from a multicarrier signal," and "applying a least squares function to the residual signal for at least one carrier of the multi-carrier signal, thereby generating a minimized residual signal for the at least one carrier," as recited in claim 1 and similarly recited in claims 8, 15, 17, and 18.

Yang, as discussed above, is directed to a method of reducing the peak power probability of a spread spectrum signal by clipping the signal to constrain its spectrum within error-shaped bounds. The Office Action asserted that the method described in Yang relates to multicarrier signals. However, Applicants respectfully submit that Yang makes no mention of multicarrier signals. Rather, Yang relates to the reduction of a peak to average power ratio for a signal comprising a number of CDMA channels multiplexed onto a single carrier signal. Reducing the problem to a single carrier signal avoids many of the problems and complexities of filtering a multicarrier signal. Yang does not disclose or suggest that its method could be applied to multicarrier signals.

Furthermore, the method disclosed in Yang describes the generation of a residual signal by determining the difference between the single carrier signal and the single carrier signal which has been hard-clipped. This residual signal is then filtered before being combined with the original signal in order to reduce the peak power probability of the signal. As acknowledged by the Office Action, Yang fails to disclose or suggest "applying a least squares function to the residual signal for at least one carrier of the

multi-carrier signal, thereby generating a minimized residual signal for the at least one carrier." The Office Action cites Wright as allegedly disclosing this limitation of the claims. Applicants respectfully disagree and submit that Wright fails to cure this deficiency in Yang.

Wright, as discussed above, discloses a method for reducing a peak to average signal level exhibited by a single or multicarrier multibearer waveforms. In particular, Wright describes the operation of a de-cresting pulse generation circuit that can provide multiple band-limited pulses to de-crest the composite multi-carrier signal. The de-cresting pulse generation circuit comprises a comparator which determines whether to apply single or multiple cancellation pulses by comparing received signals "to reference information of the intrinsic waveform. The reference information can include the average, the peak, and other pertinent signal statistics to determine whether to apply cancellation pulses to de-crest the composite multicarrier signal" (Wright, paragraph 0148). The details of the calculation performed by the comparator are not disclosed in Wright. Wright only mentions that the comparator calculates a duration for a cancellation pulse and instructs the impulse generator to provide a sequence of impulses to the pulse generator (Wright, paragraph 0149). Since the comparator is the only component of Wright that receives the composite multicarrier signal, and the only output of the comparator is instructions for pulse generation, Applicants respectfully submit that Wright fails to disclose or suggest a residual signal, as recited in the present claims.

Wright also describes a weight generator which provides weight values to the pulse generator. The weight values are used by the pulse generator to vary an amount of a band-limited de-cresting pulse injected into a channel according to the weight value corresponding to the channel. The method of calculation employed by the weight generator is not described by Wright. Each impulse supplied by the impulse generator is applied to a set of 'N' multipliers in parallel corresponding to 'N' channels in the composite multicarrier signal. The impulses are multiplied by a corresponding weighting factor and the resulting signals pass through a set of Gaussian pass-band filters arranged in parallel before being summed to provide a cancellation signal that can be used to reduce or eliminate relatively high amplitude signal crests.

In other words, the system disclosed by Wright compares the composite multicarrier signal along with individual channel inputs and corresponding frequency inputs with stored reference information in a comparator, and then, under control of the comparator, generates a series of Gaussian pulses which, when combined with the composite multicarrier signal, reduce or eliminate relatively high amplitude signal crests. Applicants note that there is no disclosure of the calculation methods used in the comparator and weight generator of Wright, or the use of a least squares function. Therefore, Applicants respectfully submit that Wright fails to disclose or suggest "applying a least squares function to the residual signal for at least one carrier of the multi-carrier signal, thereby generating a minimized residual signal for the at least one

carrier." Yang, as acknowledged by the Office Action, also fails to disclose or suggest this limitation of the claims.

Moreover, Applicants respectfully submit that Wright teaches away from the claimed invention. As mentioned above, the present invention relates to the reduction of the peak-to-mean average amplitude in a signal transmitted in a power amplifier, and particularly, but not exclusively, to such reduction in the power amplifier of a multicarrier communication system utilizing an EDGE clipper. The introduction of amplitude modulating pulses into EDGE systems is known to be particularly undesirable due to the effect on other signal properties (See Wright, paragraph 0164). The present invention, however, applies a least squares function in order to minimize a cost function with respect to the signal properties that must be maintained and the amount of clipping required for a residual signal that can be used to reduce signal peaks in the composite signal. The use of the least squares function allows embodiments of the present invention to be used in relation to EDGE systems. Applicants submit that Wright explicitly teaches away from the present invention in paragraph 0164, for example, where it describes techniques that modify the amplitude of the underlying signals to be "undesirable and may not be permissible" in an EDGE system.

Thus, for at least the reasons discussed above, Applicants respectfully assert that the combination of Yang and Wright fails to disclose or suggest "generating a residual signal from a multicarrier signal," and "applying a least squares function to the residual signal for at least one carrier of the multi-carrier signal, thereby generating a minimized

residual signal for the at least one carrier," as recited in claim 1 and similarly recited in claims 8, 15, 17, and 18. Consequently, Applicants respectfully submit that the rejection of claims 1, 8, and 15 be withdrawn.

Claims 2-5, 9-12, and 16 are dependent upon claims 1, 8, and 15, respectively. As such, claims 2-5, 9-12, and 16 should be allowed for at least their dependence upon claims 1, 8, and 15, and for the specific limitations recited therein.

Claims 6-7 and 13-14 were objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. As discussed above, Applicants respectfully submit that claims 1 and 8, upon which claims 6-7 and 13-14 are dependent, recite subject matter which is neither disclosed nor suggested by the cited prior art. Consequently, Applicants submit that claims 6-7 and 13-14 are allowable in their current form.

Applicants respectfully submit that Yang and Wright, whether viewed individually or combined, fail to disclose or suggest all of the elements of the claimed invention. These distinctions are more than sufficient to render the claimed invention unanticipated and unobvious. It is therefore respectfully requested that all of claims 1-18 be allowed, and this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by

telephone, the applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

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Enclosures: Formal Drawings
Petition for Extension of Time
Additional Claim Fee Transmittal